69

Trapping and scattering of 2-DOF system in/on a potential well

Yam Aksenton[1], Oleg Gendelman[1], Alexander Fidlin[2]
[1]Technion - Israel Institution of Technology, Haifa, Israel. [2]Karlsruhe Institute of Technology, Karlsruhe, Germany

Abstract

Abstract:

Classic Mechanical models of non-linear potential wells are of great importance in modern science and engineering and are widely researched and explored. Most research on the topic focuses on escape dynamics under different forcing excitations, revealing their governing parameters and equations with different methods. Our research considers the opposite problem with respect to the traditional escape dynamics - the problem of scattering and trapping. As a simple example, we treat a 2DOF system inside a non-linear potential well.

Many fields of science consider the interaction of 2DOF system with non-linear potentials, such as microelectromechanical systems (MEMS) [1,2]. Trapping and scattering of particles in\on a potential well in particular are of interest in chemical reactions [3,4]. The system is analyzed through numerical simulations and different phenomena are explored in hopes of finding predictable results. When the system is fully Hamiltonian, we expect only scattering to occur, as the system has enough energy to escape so it eventually would. When the system is scattered it decays to a motion of a simple 2DOF oscillator, the amplitude of oscillations generally chaotic but for some cases it may be predicted through asymptotic analysis. When damping is present, the system may get trapped and meet certain equilibria.

References:

[1.] "An Experimental and Theoretical Investigation of Dynamic Pull-In in MEMS Resonators Actuated Electrostatically" in Journal of Microelectromechanical Systems. Alsaleem F. M., Younis M. I., Ruzziconi L., vol. 19, no. 4, pp. 794-806, 2010

[2.] "On the dynamic response of electrostatic MEMS switches." in Journal of Microelectromechanical Systems. Leus V., Elata D.: 1, s.l.: IEEE Xplore, 2008, Vol. 17. 236-243

[3.] "Trapping Neutral Molecules in a Traveling Potential Well". Bethlem H. L., Berden G., Van Roij A. J. A, Crompvoets F. M. H., Meijer G.: s.l.: American Physical Society, 2000, Vol. 84. 5744- 5747.

[4.] “Space charge trappign in electrical potential well caused by permanent and induced dipoles for LDPE/MgO nanocomposite." Takada T., Hayase Y., Tanaka Y., Okamoto Y. 1, s.l. : IEEE explore, 2008, Vol. 15. 152-160.

Categories

TND: Transient and Non-stationary Dynamics